Colorado Department of Public Health and Environment

FAQs on Air Quality Modeling Data and Techniques

Contents

What versions of the AERMOD modeling system components should I use?

Use the latest versions available on U.S. EPA's SCRAM webpage.

What meteorological data do I use?

Contact the Division if site-specific meteorological data will be collected to ensure that the tower site is in a representative location and that the data will meet all the requirements of completeness and standards of reliability and accuracy. Monitoring guidance and contact information are available at: http://www.colorado.gov/airquality/monitoring_docs.aspx

Request meteorological data from the Division's modeling staff. The request will be fulfilled upon receipt of the following information:

- Coordinate (lat/long or UTM) of source location, including datum;
- Source location identified on map(s) – topographical map (preferably 1/24,000);
- Brief description of the sources of emissions - stack vs. fugitive, stack heights, source types (e.g., engine, turbine, etc).

What is the meteorological data selection process?

Beginning with the promulgation of AERMOD in 2005, meteorological data used for AERMOD applications is assessed for representativeness as discussed in the current version (November 9, 2005) of Appendix W to 40 CFR Part 51.

An air quality meteorologist/modeler assesses the source location based on the following datasets:

- Topographic maps and elevation data;
- Land cover (surface characteristics);
- Annual precipitation; and
- Wind data (direction, frequency, speed) for daytime hours, nighttime hours, and an annual period(s) from meteorological datasets collected at locations with similar terrain, land cover, and annual precipitation.

From the above information, the air quality meteorologist/modeler assesses the expected conditions at the source location, which includes

- Wind directions, speeds, and frequency; and
- Cloud cover, mixing heights, and turbulence.

These expected conditions are considered for each source type to determine

- The locations at which source impacts would occur under the various transport and dispersion conditions expected at the source location, including whether downwash could be a factor;
- Which transport and dispersion conditions is likely to cause the maximum impacts and where they would occur; and
- If any mesoscale/microscale meteorological conditions/systems could affect dispersion conditions at the source location and how this could affect maximum impacts.

Using all of the above information and drawing from the expertise of other air quality meteorologists and dispersion modelers as necessary, the air quality meteorologist/modeler identifies one dataset that best matches conditions expected at the source location from the available meteorological datasets known to the Division meteorologists/modelers and that meet the completeness requirement. Due to the limited number of meteorological datasets and the highly variable conditions that exist in Colorado, the "best match" meteorological dataset may only be partially representative of the expected conditions at the source location. In these cases, the meteorological dataset may be missing conditions that would cause the expected maximum design concentrations. When this situation occurs, the "best match" meteorological data is most suitable for use in a screening analysis (the highest concentration is used as the design concentration) to ensure impact are not under-predicted.

What if I disagree with the meteorological determination or associated design value?

If the applicant/consultant disagrees with the meteorological determination, he/she can present data to support a change to the determination. The supporting documentation/justification needs to be scientifically-based (e.g., scientific journal article, textbook, meteorological data from a similar location). Meteorological determinations have changed when such information is presented to the air quality meteorologist/modeler if the justification is verifiable and relevant.

A meteorological analysis alone may not provide sufficient information to identify the dataset to be adequately representative of transport and dispersion between the source and areas where maximum design concentrations are anticipated to occur. When conditions associated with the anticipated maximum design concentrations are adequately represented in the meteorological dataset, the modeled design values occur at locations expected to be highly impacted due to meteorology (including frequency, duration and magnitude of hourly wind conditions), terrain, downwash, and/or plume characteristics. Thus, model-estimated concentrations that account for the effects from all input data (meteorology, terrain, downwash, and initial plume conditions) are

needed to perform this assessment. This information is usually available well after the meteorological determination has been completed since it involves the execution of the various modeling components (BPIPPRM, AERMAP, and AERMOD) and their setups are dependent on the facility design/layout. If the meteorological dataset has not been identified as adequately representative and model results show the contrary supporting the situation described above, the Division's modeling staff should be contacted to evaluate if the use of an alternative design concentration is appropriate and obtain approval prior to the submittal of the ambient impact analysis/modeling. Design values have changed when such information is verifiable, relevant and provided to the air quality meteorologist/modeler.

It is possible that a partially representative meteorological dataset could contain conditions that are not plausible at the source location. The use of an alternative design value (e.g., high-2nd-high through high-(N+1)-high value, where N is the number of meteorological data years) could be justified if meteorological conditions associated with the highest ranked values are not plausible for the site (an exception is 24-hr $PM_{2.5}$ for which 1st-highest 24-hr average concentration values averaged over N years of meteorological data modeled is used when secondary $PM_{2.5}$ formation is not addressed). An example is the occurrence of the highest impacts due to plume impingement on higher terrain from cross valley winds in the meteorological data set when winds are expected to be channeled by the valley for those hours. Model-estimated concentrations that account for the effects from all input data (meteorology, terrain, downwash, and initial plume conditions) are needed to perform this assessment. This information is usually available well after the meteorological determination has been completed since it involves the execution of the various components of the modeling system (BPIPPRM, AERMAP, AERMOD) and their setups are dependent on the facility design/layout. If such situations are discovered during the preparation of the application/modeling submittal, the Division's modeling staff should be contacted to evaluate if the use of an alternative design concentration/meteorological dataset is appropriate and obtain approval prior to the submittal of the ambient impact analysis/modeling. Design values/meteorological dataset have changed when such information is verifiable, relevant and provided to the air quality meteorologist/modeler.

How do I model 1-hr NO_2 impacts?

Initially, use EPA's "Tier 1" approach (100% conversion of NO_X to NO_2). If impacts are unacceptably high with Tier 1, use Tier 3 (OLM) for estimating 1-hr NO_2 impacts. Tier 3 NO to NO_2 conversion is discussed in a 2011 U.S. EPA memorandum (pages 6-8)[1]. Upon request from the Division's modeling staff, the ozone data and instructions for implementing OLM will be provided. A Division permit engineer/unit will review the in-stack NO_2/NO_X ratio for each piece of equipment. To minimize delays and avoid modeling revisions, contact the Division's

[1] U.S. EPA March 1, 2011 memorandum "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hr NO_2 National Ambient Air Quality Standard"

permitting staff/unit to determine appropriate in-stack ratios before the permit application is submitted.

What background concentration should I use?

A single value background concentration per pollutant/averaging period is provided by the Division upon receipt of a completed Background Concentration Request Form.

Upon request, refinement of a single value background concentration received from the above request may be conducted by the Division's modeling staff, if applicable, appropriate, and justified.

How do I obtain a nearby source inventory?

Inventory Data Retrieval Requests are provided by the Division's inventory staff upon request.

What elevation data files do I use?

Use the USGS National Elevation Dataset (NED) with a minimum resolution of 1/3 arc-second. Download the appropriate NED data from: [page under construction, please check back later].

How do I determine the base elevation of emission units and structures and receptors at and surrounding the facility?

Use survey data of existing site grading or planned site grading contours, as appropriate, to determine the base elevation of emission units and structures and receptors at and surrounding the facility. Submit a plot plan of the permitted facility showing the grading contours and the location of all emission units, structures and fence line receptors for verification purposes.

How do I model haul roads?

Model haul roads as volume or area sources and in accordance with U.S. EPA's AERMOD Implementation Guidance. The characterization of haul roads can follow recommended procedures in either of the following publications:

- US EPA study "Modeling Fugitive Dust Impacts From Surface Coal Mining Operations - Phase II: Model Evaluation Protocol, October 25, 1994 with spacing according to AERMOD User's Guide (page 3-17) & ISC3 User's Guide Volume II (September 1995, page 1-82) - If the use of volume sources results in the reporting of "SOURCE-

RECEPTOR COMBINATIONS FOR WHICH CALCULATIONS MAY NOT BE PERFORMED" in the AERMOD output file(s), the affected volume sources need to be converted to area sources.

- US EPA Haul Road Workgroup Final Report

How do I determine initial lateral and vertical dimensions?

Use procedures in Table 3-1 of the AERMOD User's Guide.

How do I model flares?

Use the effective stack parameters discussed in the AERSCREEN User's Guide.

How do I model blasts/detonations?

Model blasts with a volume source(s) that represents the initial dimensions of the blast plume.

How do I model emergency generators in a 1-hr NO_2 impact analysis?

For a 1-hr NO_2 impact analysis, model emergency equipment with an average hourly rate; however, some circumstances necessitate the use of the maximum hourly emission (refer to 2011 U.S. EPA memorandum (pages 7-11)[1]).

What should I do if my impact analysis indicates violations of an applicable standard?

Verify that the model setup is appropriate and error-free, and revisit the design and/or operation of the facility and its emission sources. U.S. EPA discusses the use of "good engineering practice" stack height in a 2010 memorandum[2] and the Colorado Modeling Guideline (page 19) provides suggestions that improve dispersion characteristics and/or lower impacts. Contact the Division's modeling staff if there are any questions.

[2] U.S. EPA June 28, 2010 memorandum "General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 Significant Impact Level"